

Factors Assessed in Watershed Evaluations

Surface Water Quality

SCDHEC's Bureau of Water and Bureau of Environmental Services ensure that the water in South Carolina is safe for drinking and recreation, and that it is suitable to support and maintain aquatic flora and fauna. Functions include planning, permitting, compliance assurance, enforcement, and monitoring. This section provides an overview of water quality evaluation and protection activities.

Monitoring

In an effort to evaluate the State's water quality, the Department operates and collects data from a statewide network of ambient monitoring sites. The ambient monitoring network is directed toward determining long-term water quality trends, assessing attainment of water quality standards, identifying locations in need of additional attention, and providing background data for planning and evaluating stream classifications and standards.

Ambient monitoring data are also used in the process of formulating permit limits for wastewater discharges with the goal of maintaining State and Federal water quality standards and criteria in the receiving streams in accordance with the goals of the Clean Water Act. These standards and criteria define the instream chemical concentrations that provide for protection and reproduction of aquatic flora and fauna, help determine support of the classified uses of each waterbody, and serve as instream limits for the regulation of wastewater discharges or other activities. In addition, by comparing the ambient monitoring network data to the State Water Quality Standards, these data are used in the preparation of the biennial §305(b) report to Congress, which provides a general summary of statewide water quality, and the §303(d) list of impaired waters with respect to attainment of classified uses.

Extensive revisions to SCDHEC's ambient water quality monitoring network were implemented in 2001. One of the primary purposes of the changes was to establish a network of permanent sites with a greater focus on watersheds. Another goal was to establish a more consistent sampling frequency and parameter coverage at the permanent sites. Thus while most of the previous sampling locations were maintained, the sampling frequency and parameter coverage at each may have changed.

The previous monitoring design was comprised of four main station types: primary (P), secondary (S), watershed (W), and biological (BIO) stations. The new station types include: Integrator (INT), Special Purpose (SPRP), Summer-Only (SUMM), Sediment-Only (SEDM), Random Stream for year ## (RS##), Random Lake for year ## (RL##), Random Tide Creek for year ## (RT##), or Random Open Water for year ## (RO##). *The station descriptions depicting any transition in station types and/or coverage during the study period are located in each watershed evaluation.*

Primary stations are sampled on a monthly basis year round. The static primary station network is operated statewide, and receives the most extensive parameter coverage, thus making it best suited for detecting long-term trends. Integrator Sites are the approximate equivalent under the new design. Integrator Sites target the furthest downstream access of each of the 11-digit watershed units in the state, as well as the major waterbodies that occur within these watershed units. Special Purpose Sites are also

permanent, fixed-location sites, but represent locations of special interest to the Department that do not meet the location criteria of Integrator Sites.

Secondary stations are sampled monthly from May through October, a period critical to aquatic life, and characterized by higher water temperatures and lower flows. Secondary stations are located in areas where specific monitoring is warranted due to point source discharges, or in areas with a history of water quality problems. Secondary station parameter coverage is less extensive and more flexible than primary or watershed station coverages. The number and locations of secondary stations have greater annual variability than do those in the primary station network, and during a basin's target year may have parameter coverage and sampling frequency duplicating that of primary or watershed stations. Summer-Only Sites are the equivalent under the new design. There are very few Summer-Only Sites as they are intended to track specific reservoir eutrophication concerns.

Watershed stations are sampled on a monthly basis, year round, during a basin's target year. Additional watershed stations may be sampled monthly from May through October to augment the secondary station network. Watershed stations are located to provide more complete and representative coverage within the larger drainage basin, and to identify additional monitoring needs. Watershed stations have the same parameter coverage as primary stations. Under the new design, Watershed stations are locations with extensive historic monitoring data (e.g. primary or secondary monitoring sites under the previous design). Changes in water quality can be identified by comparison of the new data to the historic data.

A statewide Probability-Based, or random sampling, component is part of the new monitoring design. A probability-based monitoring design is a type of a survey design in which the population of interest is sampled in a fashion that allows statements to be made about the whole population based on a subsample, and produces an estimate of the accuracy of the assessment results. The advantage of the probability-based sampling design is that statistically valid statements about water quality can be made about large areas based on a relatively small subsample. Separate monitoring schemes have been developed for stream, lake/reservoir, and estuarine resources. Each year a new statewide set of probability-based random sites is selected for each waterbody type. Random Sites are sampled on a monthly basis for one year with the same parameter coverage as Integrator Sites. The data from those Random Sites located within this basin are included in this assessment.

Ambient biological trend monitoring is conducted to collect data to indicate general biological conditions of State waters that may be subject to a variety of point and nonpoint source impacts. Ambient biological sampling is also used to establish regional reference or "least impacted" sites from which to make comparisons in future monitoring. Additionally, special macroinvertebrate studies, in which stream specific comparisons among stations located upstream and downstream from a known discharge or nonpoint source area, are used to assess impact.

Qualitative sampling of macroinvertebrate communities is the primary bioassessment technique used in ambient biological trend monitoring. A habitat assessment of general stream habitat availability and a substrate characterization is conducted at each site. Annual ambient biological monitoring is conducted during low flow "worst case" conditions in July - September. Some coastal plain streams that have no flow conditions in the summer months may be sampled in the winter (January-March). This

technique may also be used in special studies for the purpose of determining if, and to what extent, a wastewater discharge or nonpoint source runoff is impacting the receiving stream. A minimum of two sample locations, one upstream and one downstream from a discharge or runoff area, is collected. At least one downstream recovery station is also established when appropriate. Sampling methodology follows procedures described in Standard Operating Procedures, Biological Monitoring. Only sites described as 'BIO' will collect information on the macroinvertebrate communities used in the ambient biological trend monitoring.

Many pollutants may be components of point source discharges, but may be discharged in a discontinuous manner, or at such low concentrations that water column sampling for them is impractical. Some pollutants are also common in nonpoint source runoff, reaching waterways only after a heavy rainfall; therefore, in these situations, the best media for the detection of these chemicals are sediment and fish tissue where they may accumulate over time. Their impact may also affect the macroinvertebrate community.

Aquatic sediments represent a historical record of chronic conditions existing in the water column, and sediment samples are analyzed at selected monitoring sites. Pollutants bind to particulate organic matter in the water column and settle to the bottom where they become part of the sediment "record". Accumulated sediments not only reflect the impact of point source discharges, but also incorporate nonpoint source pollution washed into the stream during rain events. As a result, contaminant concentrations originating from irregular and highly variable sources are recorded in the sediment. The sediment concentrations at a particular location do not vary as rapidly with time as do the water column concentrations. Thus, the sediment record may be read at a later time, unrelated to the actual release time. Lakes act as settling basins for materials entering the lake system directly from a discharge or indirectly from the land surface washed into streams. Therefore, it is not unusual for lake sediment concentrations to be higher than sediment concentrations found in streams.

The ambient monitoring program has the capability of sampling a wide range of media and analyzing them for the presence or effects of contaminants. Ambient monitoring data from 71 stations were reviewed for the Edisto River Basin.

Natural Swimming Areas

Although all waters of the State are protected for swimming, some areas are more popular than others and may require closer monitoring. Currently monitored areas are located and discussed in the appropriate watershed evaluations.

Classified Waters, Standards, and Natural Conditions

The waters of the State have been classified in regulation based on the desired uses of each waterbody. State standards for various parameters have been established to protect all uses within each classification. The water-use classifications that apply to this basin are as follows.

Class ORW, or "outstanding resource waters", are freshwaters or saltwaters that constitute an outstanding recreational or ecological resource, or those freshwaters suitable as a source for drinking water supply purposes, with treatment levels specified by the Department.

Class A were freshwaters that were suitable for primary contact recreation. This class was also suitable for uses listed as Class B. As of April 1992, Class A and Class B waters were reclassified as Class FW, which protects for primary contact recreation.

Class B were freshwaters that were suitable for secondary contact recreation and as a source for drinking water supply, after conventional treatment, in accordance with the requirements of the Department. These waters were suitable for fishing, and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. This class was also suitable for industrial and agricultural uses. The main difference between the Class A and B freshwater was the fecal coliform standard. Class A waters were not to exceed a geometric mean of 200/100ml, based on 5 consecutive samples during any 30 day period; nor were more than 10% of the total samples during any 30 day period to exceed 400/100ml. Class B waters were not to exceed a geometric mean of 1000/100ml, based on 5 consecutive samples during any 30 day period; nor were more than 20% of the total samples during any 30 day period to exceed 2000/100ml. As of April 1992, Class A and Class B waters were reclassified as Class FW, which protects for primary contact recreation.

Class FW, or "freshwaters", are freshwaters that are suitable for primary and secondary contact recreation and as a source for drinking water supply, after conventional treatment, in accordance with the requirements of the Department. These waters are suitable for fishing, and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. This class is also suitable for industrial and agricultural uses.

Class SFH, or "shellfish harvesting" waters, are tidal saltwaters protected for shellfish harvesting, and are suitable also for uses listed in Classes SA and SB.

Class SA comprises "tidal saltwaters" suitable for primary and secondary contact recreation, crabbing and fishing. These waters are not protected for harvesting of clams, mussels, or oysters for market purposes or human consumption. The waters are suitable for the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora.

Class SB are "tidal saltwaters" suitable for the same uses listed in SA. The difference between the Class SA and SB saltwater concerns the DO limitations. Class SA waters must maintain daily DO averages not less than 5.0 mg/l, with a minimum of 4.0 mg/l, and Class SB waters maintain DO levels not less than 4.0 mg/l.

Class GB, or "groundwaters", include all groundwaters of the State, unless classified otherwise, which meet the definition of underground sources of drinking water.

Site specific numeric standards (*) for surface waters may be established by the Department to replace the numeric standards found in Regulation 61-68 or to add new standards not contained in R.61-68. Establishment of such standards shall be subject to public participation and administrative procedures for adopting regulations. In addition, such site specific numeric standards shall not apply to tributary or downstream waters unless specifically described in the water classification listing in R.61-69.

The standards are used as instream water quality goals to maintain and improve water quality and also serve as the foundation of the Bureau of Water's program. They are used to determine permit limits for treated wastewater dischargers and any other activities that may impact water quality. Using mathematical Wasteload Allocation Models, the impact of a wastewater discharge on a receiving stream is predicted under critical conditions following R.61-68. These predictions are then used to set limits for different pollutants on the National Pollutant Discharge Elimination System (NPDES) permits issued by the Department. The NPDES permit limits are set so that, as long as a permittee (wastewater discharger) meets the established permit limits, the discharge should not cause a standards violation in the receiving

stream. All discharges to the waters of the State are required to have an NPDES permit and must abide by those limits, under penalty of law.

Classifications are based on desired uses, not on natural or existing water quality, and are a legal means to obtain the necessary treatment of discharged wastewater to protect designated uses. Actual water quality may not have a bearing on a waterbody's classification. A waterbody may be reclassified if desired or existing public uses justify the reclassification and the water quality necessary to protect these uses is attainable. A classification change is an amendment to a State regulation and requires public participation, SCDHEC Board approval, and General Assembly approval.

Natural conditions may prevent a waterbody from meeting the water quality goals as set forth in the standards. The fact that a waterbody does not meet the specified numeric standards for a particular classification does not mean the waterbody is polluted or of poor quality. Certain types of waterbodies (ie. swamps, lakes, tidal creeks) may naturally have water quality lower than the numeric standards. A waterbody can have water quality conditions below standards due to natural causes and still meet its use classification. A site specific numeric standard may be established by the Department after being subjected to public participation and administrative procedures for adopting regulations. Site specific numeric standards apply only to the stream segment described in the water classification listing, not to tributaries or downstream unspecified waters.

Water Quality Indicators

Water quality data are used to describe the condition of a waterbody, to help understand why that condition exists, and to provide some clues as to how it may be improved. Water quality indicators include physical, chemical, and biological measurements. Copies of the Standard Operating Procedures used for these measurements are available from the Department's Bureau of Water and the Bureau of Environmental Services. The current State of S.C. Monitoring Strategy is available on our website at www.scdhec.gov/eqc/admin/html/eqcpubs.html#wqreports and describes what parameters are sampled, where they are sampled, and how frequently.

MACROINVERTEBRATE COMMUNITY

Macroinvertebrates are aquatic insects and other aquatic invertebrates associated with the substrates of waterbodies (including, but not limited to, streams, rivers, tidal creeks, and estuaries). Macroinvertebrates can be useful indicators of water quality because these communities respond to integrated stresses over time that reflect fluctuating environmental conditions. Community responses to various pollutants (e.g. organic, toxic, and sediment) may be assessed through interpretation of diversity, known organism tolerances, and in some cases, relative abundances and feeding types.

FISH TISSUE

Many pollutants occur in such low concentrations in the water column that they are usually below analytical detection limits. Over time many of these chemicals may accumulate in fish tissue to levels that are easily measured. By analyzing fish tissue it is possible to see what pollutants may be present in

waterbodies at very low levels. This information can also be used to determine if consumption of the fish poses any undue human health concerns and to calculate consumption rates that are safe.

DISSOLVED OXYGEN

Oxygen is essential for the survival and propagation of aquatic organisms. If the amount of oxygen dissolved in water falls below the minimum requirements for survival, aquatic organisms or their eggs and larvae may die. A severe example is a fish kill. Dissolved oxygen (DO) varies greatly due to natural phenomena, resulting in daily and seasonal cycles. Different forms of pollution also can cause declines in DO.

Changes in DO levels can result from temperature changes or the activity of plants and other organisms present in a waterbody. The natural diurnal (daily) cycle of DO concentration is well documented. Dissolved oxygen concentrations are generally lowest in the morning, climbing throughout the day due to photosynthesis and peaking near dusk, then steadily declining during the hours of darkness.

There is also a seasonal DO cycle in which concentrations are greater in the colder, winter months and lower in the warmer, summer months. Streamflow (in freshwater) is generally lower during the summer and fall, and greatly affects flushing, reaeration, and the extent of saltwater intrusion, all of which affect dissolved oxygen values.

BIOCHEMICAL OXYGEN DEMAND

Five-day biochemical oxygen demand (BOD₅) is a measure of the amount of dissolved oxygen consumed by the decomposition of carbonaceous and nitrogenous matter in water over a five-day period. The BOD₅ test indicates the amount of biologically oxidizable carbon and nitrogen that is present in wastewater or in natural water. Matter containing carbon or nitrogen uses dissolved oxygen from the water as it decomposes, which can result in a dissolved oxygen decline. The quantity of BOD₅ discharged by point sources is limited through the National Pollutant Discharge Elimination System (NPDES) permits issued by the Department. The discharge of BOD₅ from a point source is restricted by the permits so as to maintain the applicable dissolved oxygen standard.

pH

pH is a measure of the hydrogen ion concentration of water, and is used to indicate degree of acidity. The pH scale ranges from 0 to 14 standard units (SU). A pH of 7 is considered neutral, with values less than 7 being acidic, and values greater than 7 being basic.

Low pH values are found in natural waters rich in dissolved organic matter, especially in Coastal Plain swamps and black water rivers. The tannic acid released from the decomposition of vegetation causes the tea coloration of the water and low pH.

High pH values in lakes during warmer months are associated with high phytoplankton (algae) densities. The relationship between phytoplankton and daily pH cycles is well established. Photosynthesis by phytoplankton consumes carbon dioxide during the day, which results in a rise in pH.

In the dark, phytoplankton respiration releases carbon dioxide. In productive lakes, carbon dioxide decreases to very low levels, causing the pH to rise to 9-10 SU.

FECAL COLIFORM BACTERIA

Fecal coliform bacteria are present in the digestive tract and feces of all warm-blooded animals, including humans, poultry, livestock, and wild animal species. Fecal coliform bacteria are themselves generally not harmful, but their presence indicates that surface waters may contain pathogenic microbes. Diseases that can be transmitted to humans through water contaminated by improperly treated human or animal waste are the primary concern. At present, it is difficult to distinguish between waters contaminated by animal waste and those contaminated by human waste.

Public health studies have established correlations between fecal coliform numbers in recreational and drinking waters and the risk of adverse health effects. Based on these relationships, the USEPA and SCDHEC have developed enforceable standards for surface waters to protect against adverse health effects from various recreational or drinking water uses. Proper waste disposal or sewage treatment prior to discharge to surface waters minimizes this type of pollution.

NUTRIENTS

Oxygen demanding materials and plant nutrients are common substances discharged to the environment by man's activities, through wastewater facilities and by agricultural, residential, and stormwater runoff. The most important plant nutrients, in terms of water quality, are phosphorus and nitrogen. In general, increasing nutrient concentrations are undesirable due to the potential for accelerated growth of aquatic plants, including algae.

The forms of nitrogen routinely analyzed at SCDHEC stations are ammonia and ammonium nitrogen (NH_3/NH_4), total Kjeldahl nitrogen (TKN), and nitrite and nitrate nitrogen (NO_2/NO_3). Ammonia and ammonium are readily used by plants. TKN is a measure of organic nitrogen and ammonia in a sample. Nitrate is the product of aerobic transformation of ammonia, and is the most common form used by aquatic plants. Nitrite is usually not present in significant amounts. Total nitrogen is the sum of TKN and NO_2/NO_3 .

Total phosphorus (TP) is commonly measured to determine phosphorus concentrations in surface waters. TP includes all of the various forms of phosphorus (organic, inorganic, dissolved, and particulate) present in a sample.

CHLOROPHYLL *a*

Nuisance plant growth can create imbalances in the aquatic community, as well as aesthetic and access issues. Invasive growth of rooted aquatic vegetation can clog boat motors and create disagreeable conditions for swimming and water skiing. High densities of microscopic algae (phytoplankton) can cause wide fluctuations in pH and dissolved oxygen, and can cause undesirable shifts in the composition of aquatic life, or even fish kills. Chlorophyll *a* is a dominant photosynthetic pigment in plants and is used as an indicator of the density of phytoplankton in the water column. The process of cultural eutrophication, from increased plant nutrients, is particularly noticeable in lakes. Continuous flushing in

streams prevents the development of significant phytoplankton populations and the resultant chemical changes in water quality.

TURBIDITY

Turbidity is an expression of the scattering and absorption of light through water. The presence of clay, silt, fine organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms increases turbidity. Increasing turbidity can be an indication of increased runoff from land. It is an important consideration for drinking water as finished water has turbidity limits.

TOTAL SUSPENDED SOLIDS

Total Suspended Solids (TSS) are the suspended organic and inorganic particulate matter in water. Although increasing TSS can also be an indication of increased runoff from land, TSS differs from turbidity in that it is a measure of the mass of material in, rather than light transmittance through, a water sample. High TSS can adversely impact fish and fish food populations and damage invertebrate populations. There are no explicit State standards for TSS.

HEAVY METALS

Concentrations of cadmium, chromium, copper, lead, mercury, and nickel in water are routinely measured by the Department to compare to State standards intended to protect aquatic life and human health. These metals occur naturally in the environment, and many are essential trace elements for plants and animals. Human activities, such as land use changes and industrial and agricultural processes have resulted in an increased flux of metals from land to water. Atmospheric inputs are also recognized as important sources of metals to aquatic systems. Metals are released to the atmosphere from the burning of fossil fuels (coal, oil, gasoline), wastes (medical, industrial, municipal), and organic materials. The metals are then deposited on land and in waterways from the atmosphere via rainfall and attached to particulates (dry deposition).

Assessment Methodology

The Watershed Water Quality Assessment is a geographically-based document that describes, at the watershed level, water quality as well as conditions and activities related to water quality. Significant revisions to South Carolina's Water Quality Standards were effective on June 22, 2001. USEPA approved these standards for use in implementing the Clean Water Act on November 28, 2001. This section provides an explanation of the information assessment methodology used to generate the watershed-level summaries. Water quality data summaries used in this assessment are presented in Appendix B.

USE SUPPORT DETERMINATION

Physical, chemical, and biological data were evaluated, as described below, to determine if water quality met the water quality criteria established to protect the State classified uses defined in S.C. Regulation 61-68, *Water Classifications and Standards*. Some waters may exhibit characteristics outside the appropriate criteria due to natural conditions. Such natural conditions do not constitute a violation of the water quality criteria. To determine the appropriate classified uses and water quality criteria for specific waterbodies and locations, refer to S.C. Regulation 61-69, *Classified Waters*, in conjunction with S.C. Regulation 61-68.

At the majority of SCDHEC's surface water monitoring stations, samples for analysis are collected as surface grabs once per month, quarter, or year, depending on the parameter. Grab samples collected at a depth of 0.3 meters are considered to be a surface measurement. At most stations sampled by boat, dissolved oxygen and temperature are sampled as a water column profile, with measurements being made at a depth of 0.3 meters below the water surface and at one-meter intervals to the bottom or at 0.3 meters, mid-depth, and bottom. At stations sampled from bridges, these parameters are measured only at a depth of 0.3 meters. For the purpose of assessment, only surface samples are used in standards comparisons and trend assessments. Because of the inability to target individual high or low flow events on a statewide basis these data are considered to represent typical physical conditions and chemical concentrations in the waterbodies sampled. All water and sediment samples are collected and analyzed according to standard procedures (SCDHEC 1997, 2001).

Results from water quality samples can be compared to State and USEPA criteria, with some restrictions due to time of collection and sampling frequency. For certain parameters, the monthly sampling frequency employed in the ambient monitoring network is insufficient for strict interpretation of the standards. The USEPA does not define the sampling method or frequency other than indicating that it should be "representative". The grab sample method is considered to be representative for the purpose of indicating excursions relative to criteria, within certain considerations. A single grab sample is more representative of a one-hour average than a four-day average, more representative of a one-day average than a one-month average, and so on; thus, when inferences are drawn from grab samples relative to criteria, sampling frequency and the intent of the criteria must be weighed. When the sampling method or frequency does not agree with the intent of the particular criterion, any conclusion about water quality should be considered as only an indication of conditions, not as a proven circumstance.

Macroinvertebrate community structure is analyzed routinely, at selected stations, as a means of detecting adverse biological impacts on the aquatic fauna of the state's waters due to water quality conditions that may not be readily detectable in the water column chemistry.

This water quality assessment is based on the last complete five years of available quality assured physical, chemical, and biological data (1997 - 2001). Because of the data quality assurance and quality control process outcome, only total phosphorus data collected from 1996 through June 1998 were included in this assessment.

AQUATIC LIFE USE SUPPORT

One important goal of the Clean Water Act, the South Carolina Pollution Control Act, and the State Water Quality Classifications and Standards is to maintain the quality of surface waters to provide for the survival and propagation of a balanced indigenous aquatic community of fauna and flora. The degree to which aquatic life is protected (Aquatic Life Use Support) is assessed by comparing important water quality characteristics and the concentrations of potentially toxic pollutants with numeric criteria.

Support of aquatic life uses is determined based on the percentage of numeric criteria excursions and, where data are available, the composition and functional integrity of the biological community. The term excursion is used to describe a measured pollutant concentration that is outside of the acceptable range as defined by the appropriate criterion. Some waters may exhibit characteristics outside the appropriate criteria due to natural conditions. Such natural conditions do not constitute a violation of the water quality criteria. A number of waterbodies have been given waterbody-specific criteria for pH and dissolved oxygen, which reflect natural conditions. To determine the appropriate numeric criteria and classified uses for specific waterbodies and locations, please refer to S.C. Regulation 61-68, *Water Classifications and Standards* and S.C. Regulation 61-69, *Classified Waters*.

If the appropriate criterion for **dissolved oxygen and pH** are contravened in 10 percent or less of the samples, the criterion is said to be fully supported. If the percentage of criterion excursions is greater than 10 percent, but less than or equal to 25 percent, the criterion is partially supported, unless excursions are due to natural conditions. If there are more than 25 percent excursions, the criterion is not supported, unless excursions are due to natural conditions. The decision that criteria excursions are due to natural conditions is determined by consensus and/or the professional judgment of SCDHEC staff with specific local knowledge.

If the appropriate acute aquatic life criterion for any individual **toxicant (e.g. heavy metals, priority pollutants, ammonia)** is exceeded more than once in five years, representing more than 10 percent of the samples collected, the criterion is not supported. If the acute aquatic life criterion is exceeded more than once, but in less than or equal to 10 percent of the samples, the criterion is partially supported. The USEPA criteria to protect aquatic life for most toxicants are specified as a four-day average and a one-hour average, and have been adopted as state criteria. Because samples are collected as grab samples, and because of sampling frequency, comparisons to chronic toxicity criteria (four-day average concentration) are considered inappropriate; therefore, only the acute criterion (one-hour average) for the protection of aquatic life is used in the water quality assessment.

The total recoverable metals criteria for **heavy metals** are adjusted to account for solids partitioning following the approach set forth in the Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria, October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington, DC 20460; and 40CFR0131.36(b)(1). Under this approach, a default TSS value of 1 mg/L is used. Where the metals criteria are hardness based, a default value of 25 mg/L is used for waters where hardness is 25 mg/l or less.

If the appropriate criterion for **turbidity** in all waters, and for waters with **numeric total phosphorus, total nitrogen, and chlorophyll-a** criteria is exceeded in more than 25 percent of the

samples, the criterion is not supported. If the criterion is exceeded in 25 percent of the samples or less, then the criterion is fully supported.

If the conclusion for any single parameter is that the criterion is “not supported”, then it is concluded that aquatic life uses are not supported for that waterbody, at that monitoring location. If there are no criteria that are “not supported”, but the conclusion for at least one parameter criterion is “partially supported”, then the conclusion is aquatic life uses are partially supported. Regardless of the number of samples, no monitoring site will be listed as partially or not supporting for any pollutant based a single sample result because of the possibility of an anomalous event.

The goal of the standards for aquatic life uses is the protection of a balanced indigenous aquatic community; therefore, biological data is the ultimate deciding factor, regardless of chemical conditions. If biological data shows a healthy, balanced community, the use is considered supported even if chemical parameters do not meet the applicable criteria.

MACROINVERTEBRATE DATA INTERPRETATION

Macroinvertebrate community assessment data are used to directly determine Aquatic Life Use Support and to support determinations based on water chemistry data. Macroinvertebrate community data may also be used to evaluate potential impacts from the presence of sediment contaminants. Aquatic and semi-aquatic macroinvertebrates are identified to the lowest practical taxonomic level depending on the condition and maturity of specimens collected. The EPT Index and the North Carolina Biotic Index are the main indices used in analyzing macroinvertebrate data. To a lesser extent, taxa richness and total abundance may be used to help interpret data.

The EPT Index or the Ephemeroptera (mayflies) - Plecoptera (stoneflies) - Trichoptera (caddisflies) Index is the total taxa richness of these three generally pollution-sensitive orders. EPT values are compared with least impacted regional sites. The Biotic Index for a sample is the average pollution tolerance of all organisms collected, based on assigned taxonomic tolerance values. A database is currently being developed to establish significant EPT index levels to be used in conjunction with the Biotic Index to address aquatic life use support.

Taxa richness is the number of distinct taxa collected and is the simplest measure of diversity. High taxa richness is generally associated with high water quality. Increasing levels of pollution progressively eliminate the more sensitive taxa, resulting in lower taxa richness. Total abundance is the enumeration of all macroinvertebrates collected at a sampling location. When gross differences in abundance occur between stations, this metric may be considered as a potential indicator.

RECREATIONAL USE SUPPORT

Recreational use support is defined as the degree to which the swimmable goal of the Clean Water Act is attained and is based on the frequency of fecal coliform bacteria excursions. A fecal coliform excursion is defined as an occurrence of a bacteria concentration greater than 400/100 ml for all surface water classes. Comparisons to the bacteria geometric mean standard are not considered appropriate based on sampling frequency and the intent of the standard. If 10 percent or less of the samples are greater than 400/100 ml, then recreational uses are said to be fully supported. If the

percentage of standards excursions is greater than 10 percent, but less than or equal to 25 percent, then recreational uses are said to be partially supported. If the percentage of excursions is greater than 25 percent, then it is considered to represent nonsupport of recreational uses.

FISH CONSUMPTION USE SUPPORT

The Department uses a risk-based approach to evaluate fish tissue data and to issue consumption advisories in affected waterbodies. This approach contrasts the average daily exposure dose to the reference dose (RfD). Using these relationships, fish tissue data are interpreted by determining the consumption rates that would not be likely to pose a health threat to adult males and nonpregnant adult females. Because an acceptable RfD for developmental neurotoxicity has not been developed, pregnant women, infants, and children are advised to avoid consumption of fish from any waterbody where a mercury advisory was issued.

Fish consumption use support is determined by the occurrence of advisories or bans on consumption for a waterbody. For the support of fish consumption uses, a fish consumption advisory indicates partial use support, a consumption ban indicates nonsupport of uses.

DRINKING WATER USE SUPPORT

Nonattainment of drinking water use is indicated if the median concentration of the ambient surface water data for any pollutant exceeds the appropriate drinking water Maximum Contaminant Level (MCL), based on a minimum of three samples. Where MCLs do not exist, SCDHEC may use or develop other criteria such that pollutant concentrations or amounts do not interfere with drinking water use, actual or intended, as determined by SCDHEC.

Additional Screening and Prioritization Tools

Evaluation of water quality data and other supplemental information facilitates watershed planning. Information from the following sources is used to develop watershed-based protection and prevention strategies.

LONG-TERM TREND ASSESSMENT

As part of the watershed water quality assessments, surface data from each station are analyzed for statistically significant long-term trends using the Seasonal Kendall Test Without Correction (SKWOC) for significant serial correlation, using procedures in the WQHYDRO computer package developed by Eric Aroner of WQHYDRO Consulting. Flows are not available for most stations, and the parametric concentrations are not flow-corrected. Seasonal Kendall's Tau Analysis is used to test for the presence of a statistically significant trend of a parameter, either increasing or decreasing, over a fifteen-year period. It indicates whether the concentration of a given parameter is exhibiting consistent change in one direction over the specified time period. A two sided test at $p=0.1$ is used to determine statistically

significant trends, and the direction of trend. An estimate of the magnitude of any statistically significant trend is calculated.

A rigorous evaluation for trends in time-series data usually includes a test for autocorrelation. The data are not tested for autocorrelation prior to the trend analysis. It is felt that autocorrelation would not seriously compromise a general characterization of water quality trends based on such a long series of deseasonalized monthly samples.

One of the advantages of the seasonal Kendall test is that values reported as being below detection limits (DL) are valid data points in this nonparametric procedure, since they are all considered to be tied at the DL value. When the DL changed during the period of interest, all values are considered to be tied at the highest DL occurring during that period. Since it is possible to measure concentrations equal to the value of the DL, values less than DL are reduced by subtraction of a constant so that they remain tied with each other, but are less than the values equal to the DL. Since fecal coliform bacteria detection limits vary with sample dilution, there is no set DL; therefore, for values reported as less than some number, the value of the number is used.

For the purposes of this assessment, long-term trends in selected parameters were examined using data collected from 1986 through 2000. In 1992, a phosphate detergent ban was instituted in South Carolina; therefore, for total phosphorus, a second trend assessment is included for the available data from 1992 through 2000. For total phosphorus, it is this second time period that is reported in the text.

SEDIMENT SCREENING

There are no sediment standards; therefore, in order to identify sediments with elevated metals concentrations, percentiles are constructed using five years of statewide sediment data. Only values greater than the detection limit were used for chromium, copper, nickel, lead, and zinc. Because so few concentrations of cadmium and mercury are measured above the detection limit, all samples were pooled for these metals. A sediment metal concentration is considered to be high if it is in the top 10% of the pooled results, and very high if it is in the top 5%. Any analytical result above detection limits is flagged for pesticides, PCBs, and other priority pollutants. Sites with noted high metals concentrations or the occurrence of other contaminants above detection limits are prioritized for the collection of biological data, or additional monitoring and investigation, to verify the true situation.

For saltwater sediments, national studies have been conducted by the National Oceanic and Atmospheric Administration (NOAA) and the State of Florida that have developed Sediment Quality Guidelines (SQGs) for the United States and the southeastern region. These SQGs summarize all published toxicology and biomonitoring studies for a given contaminant and ranked them from lowest to highest concentration where an adverse effect was observed. The tenth percentile of the ranked data, from all published studies that reported an adverse effect, is termed the Effects Range Low (ERL) or Threshold Effects Level (TEL) and represents the threshold concentration for toxicity to occur. The median concentration where adverse effects in benthos are observed (the fiftieth percentile) is termed the Effects Range Median (ERM) or Probable Effects Levels (PEL). Measured sediment contaminant levels may be compared with ERLs/ERMs or TELs/PELs to predict potential probability for sediment bound contaminants to cause toxicity in benthic faunal communities. Saltwater sediment contaminant levels

were compared with existing sediment quality guidelines by individual compound. Sites with sediments which had individual chemical contaminant concentrations which exceeded ERL/TEL and ERM/PEL guideline levels are identified to indicate that trace metal, pesticide, PAH or PCB concentrations exceeded levels potentially toxic to estuarine organisms.

Ocean Water Quality

SCDHEC's Ocean Water Quality Monitoring Program allows the public to make informed decisions concerning recreating in waters with the potential to cause adverse health effects. Routine monitoring of ocean front beaches by SCDHEC began in 1998 in Horry and Georgetown counties and was expanded to include all coastal counties in 2000. Beginning in 2002, SCDHEC has been awarded grant monies by EPA under the Beaches Environmental Assessment and Coastal Health (BEACH) Act. This grant money has allowed South Carolina to continue and to enhance a comprehensive monitoring and public notification program. To effectively allocate available resources, EPA required all monitoring and notification efforts be based on potential risk and intensity of use. An initial evaluation and classification of all beaches was performed to establish a three-tier monitoring program with Tier 1 beaches being highest priority. All beaches within the Edisto River Basin were classified as either Tier 2 or 3 due to limited risk and/or use. Edisto Island is classified as a Tier 2 beach and is routinely sampled twice per month, April 15 – October 15, at eleven monitoring sites. Edisto Island has consistently maintained low bacterial counts with very few samples exceeding the EPA recommended single sample limit of 104 enterococcus bacteria per 100 milliliters of water. Edingsville Beach and Botany Bay are considered Tier 3 beaches due to low use and are currently not sampled. In future years, it is hoped that resources will allow for routine sampling of all beaches according to the established tiered sampling plan.

Groundwater Quality

The state of South Carolina depends upon its groundwater resources to supply an estimated 40 percent of its residents. To monitor the ambient quality of this valuable resource, a network of existing public and private water supply wells has been established that provides groundwater quality data representing all of the State's major aquifers (see SCDHEC's Ambient Groundwater Quality Monitoring Network Report for listing of groundwater quality data). A great deal of monitoring is also being carried out at regulated sites with known or potential groundwater contamination (see SCDHEC's South Carolina Groundwater Contamination Inventory).

The ambient monitoring network has been designed to avoid wells in areas of known or potential contamination in order to analyze natural aquifer conditions. Information collected can then be used to identify variations in water chemistry among the major aquifers of South Carolina and give a general understanding of the groundwater conditions throughout the state at varying depths.

Wells sampled in the Edisto River Basin were drilled into one of four major aquifers. The most prominent aquifers utilized are the Middendorf, Black Creek, Floridan, and Surficial Sands. All well samples met state standards for Class GB groundwater (see section on Classified Waters, Standards, and

Natural Conditions). The ambient monitoring well sites are indicated in the appropriate watershed evaluations and depicted on the watershed maps.

Middendorf Aquifer

The Middendorf Aquifer directly overlies the Bedrock Aquifer and stretches from the Fall Line, where it outcrops, to the Atlantic coast, where it exceeds depths of 3000 feet. The Middendorf Aquifer is the main provider of groundwater to numerous private and public wells in the upper portion of the Edisto River Basin. It is generally composed of fairly coarse sands and therefore is capable of yielding considerable amounts of water.

The sands that make up the Middendorf Aquifer are typically clean, containing relatively few heavy minerals or organics. The aquifer, especially in the exposed recharge areas, is highly leached of soluble minerals and recharge water approaches the chemistry of distilled water. Water tends to be soft, acidic, and low in dissolved solids, with locally high iron content. This tendency changes toward the coast due to minute amounts of minerals that slowly dissolve in the water as it flows and ages. As it reaches the coastal areas, the concentration is high enough to affect the water quality; however, the Middendorf Aquifer now lies beneath waters of similar quality and more easily reached aquifers.

Floridan Aquifer

The Floridan aquifer is composed of solid limestone and is capable of yielding great quantities of water. Wells drilled in this aquifer are similar to those drilled in bedrock in that they do not use screens, but utilize open holes with a solid case up to the surface.

Water from the Floridan Aquifer is easily distinguished from all other aquifers in the state by its high concentration of calcium and its alkaline pH, ranging from 7.4 to 9.0. The hardness of this aquifer's groundwater can approach 2000 mg/l. While many aquifers tend to be low in necessary fluoride, levels in the Floridan often fall within the optimum range of 0.8 to 1.2 mg/l.

Surficial Sands Aquifer

The Surficial Sands Aquifer is a shallow, coastal aquifer that is utilized mainly by relatively shallow private wells. As its name implies, the aquifer consists mainly of sands and is the water table aquifer in most of its extent. Due to its close proximity to both the surface and the ocean, the water is predictably high in dissolved solids, has a widely varied pH ranging from 6.2 to 8.6, and has elevated levels of sodium and chloride. Amounts of dissolved solids are also widely varied, ranging from 80 to 2400 mg/l. Water pumped from this aquifer may have an obvious odor and distinct taste, but is still within standards for drinking water. Despite the higher levels of dissolved solids, this aquifer is frequently used because of its proximity to the surface and its decent yields.

NPDES Program

The Water Facilities Permitting Division and the Industrial, Agricultural, and Stormwater Permitting Division are responsible for drafting and issuing National Pollutant Discharge Elimination

System (NPDES) permits. Facilities are defined as either "major" or "minor". For municipal permits, a facility is considered a "major" if it has a permitted flow of 1 MGD or more and is not a private facility. The determination for industrial facilities is based on facility and stream characteristics, including toxicity, amount of flow, BOD (biological oxygen demand) loading, proximity of drinking water source, potential to exceed stream standards, and potential effect on coastal waters.

Permitting Process

A completed draft permit is sent to the permittee, the SCDHEC District office, and if it is a major permit, to the USEPA for review. A public notice is issued when the permit draft is finalized. Comments from the public are considered and, if justified, a public hearing is arranged. Both oral and written comments are collected at the hearing, and after considering all information, the Department staff makes the decision whether to issue the permit as drafted, issue a modified permit, or to deny the permit. Everyone who participated in the process receives a notice of the final decision. A copy of the final permit will be sent to anyone who requests it. Staff decisions may be appealed according to the procedures in R.61-72 and the rule of the Administrative Law Court of South Carolina.

The permitting Divisions use general permits with statewide coverage for certain categories of discharges. Discharges covered under general permits include utility water, potable surface water treatment plants, potable groundwater treatment plants with iron removal, petroleum contaminated groundwater, mine dewatering activities, aquaculture facilities, bulk oil and gas terminals, hydrostatic test waters (oil & gas lines), and vehicle wash waters. Additional activities proposed for general permits include ready-mix concrete/concrete products and concentrated animal feeding operations. State Land application systems for land disposal and lagoons are also permitted.

Wasteload Allocation Process

A wasteload allocation (WLA) is the portion of a stream's assimilative capacity for a particular pollutant that is allocated to an existing or proposed point source discharge. Existing WLAs are updated during the basin review process and included in permits during the normal permit expiration and reissuance process. New WLAs are developed for proposed projects seeking a discharge permit or for existing discharges proposing to increase their effluent loading at the time of application. Wasteload allocations for oxygen demanding parameters and nutrients are developed by the Water Quality Modeling Section, and WLAs for toxic pollutants and metals are developed by the appropriate permitting division.

The ability of a stream to assimilate a particular pollutant is directly related to its physical and chemical characteristics. Various techniques are used to estimate this capacity. Simple mass balance/dilution calculations may be used for a particular conservative (nondecaying) pollutant while complex models may be used to determine the fate of nonconservative pollutants that degrade in the environment. Waste characteristics, available dilution, and the number of discharges in an area may, along with existing water quality, dictate the use of a simple or complex method of analysis. Projects that generally do not require complex modeling include: groundwater remediation, noncontact cooling water, mine dewatering, air washers, and filter backwash.

Streams are designated either effluent limited or water quality limited based on the level of treatment required of the dischargers to that particular portion of the stream. In cases where the USEPA

published effluent guidelines and the minimum treatment levels required by law are sufficient to maintain instream water quality standards, the stream is said to be effluent limited. Streams lacking the assimilative capacity for a discharge at minimum treatment levels are said to be water quality limited. In cases where better than technology limits are required, water quality, not minimum requirements, controls the permit limits. The Department's Water Quality Modeling Section develops limits for numerous parameters including ammonia nitrogen (NH₃-N), dissolved oxygen (DO), and five-day biochemical oxygen demand (BOD₅). Limits for other parameters, including metals, toxics (including total residual chlorine), and nutrients are developed by the Water Facilities Permitting Division or the Industrial, Agricultural, and Stormwater Permitting Division in conjunction with support groups within the Department.

Nonpoint Source Management Program

Nonpoint source (NPS) water pollution, sometimes called “runoff pollution” or “polluted runoff” does not result from a discharge at a specific, single location (or point), but generally comes from diffuse, numerous sources. Runoff occurring after a rain event may transport sediment from plowed fields, construction sites, or logging operations, pesticides and fertilizers from farms and lawns, motor oil and grease deposited on roads and parking lots, or bacteria containing waste from agricultural animal facilities or malfunctioning septic systems. The rain moves the pollutants across the land to the nearest waterbody or storm drain where they may impact the water quality in creeks, rivers, lakes, estuaries, and wetlands. NPS pollution may also impact groundwater when it is allowed to seep or percolate into aquifers. Adverse effects of NPS pollution include physical destruction of aquatic habitat, fish kills, interference with or elimination of recreational uses of a waterbody (particularly lakes), closure of shellfish beds, reduced water supply or taste and odor problems in drinking water, and increased potential for flooding because waterbodies become choked with sediment.

Congress recognized the growing problem of nonpoint source pollution in the late 1980s, and added NPS provisions to the federal law. Section 319 of the 1987 Amendments to the Clean Water Act required states to assess the nonpoint source water pollution associated with surface and groundwater within their borders and then develop and implement a management strategy to control and abate the pollution. The first Assessment of Nonpoint Source Pollution in South Carolina accomplished this purpose. The Department's Bureau of Water manages the ongoing State NPS Management Program, which develops strategies and targets waterbodies for priority implementation of management projects. Section 319 funds various voluntary efforts, including watershed projects, which address many aspects of the pollution prevention management measure and provide education, outreach and technical assistance to various groups and agencies. Most of the projects are implemented by cooperating agencies.

Many land activities can individually or cumulatively contribute to NPS pollution. Eight categories of NPS pollution sources have been identified as contributing to water quality degradation in South Carolina: agriculture, forestry, urban areas, marinas and recreational boating, mining, hydrologic modification, wetlands and riparian areas disturbance, land disposal, and groundwater contamination. There are programs, both regulatory and voluntary, in-place that address all eight categories.

Agriculture

In South Carolina, pesticides, fertilizers, animal waste, and sediment are potential sources of agricultural NPS pollution. Agricultural activities also have the potential to directly impact the habitat of aquatic species through physical disturbances caused by livestock or equipment, and through the management of water. The State has laws and regulations that prevent NPS pollution from several agricultural sources including pesticides and animal waste. Funding programs including those under §319 grants from EPA, cost share funds from USDA under EQIP and CRP are used to implement best management practices that are not covered under regulations. Agriculture land acreage is quantified in the basin-wide and individual watershed evaluations.

Silviculture

Forests comprise a major portion of South Carolina's land base. Sixty-six percent, or 12.6 million acres, of the State's total land area is in timberland. Silvicultural practices associated with road access, harvest, and regeneration of timber present the most significant potential for NPS pollution. Silvicultural activities have the potential to degrade the State's waters through the addition of sediment, nutrients, organics, elevated temperature, and pesticides. Erosion and subsequent sedimentation are the most significant and widespread NPS problems associated with forestry practices. Sudden removal of large quantities of vegetation through harvesting or silvicultural practices can also increase leaching of nutrients from the soil system into surface waters and groundwaters. Programs to abate or control NPS pollution from forestry activities are primarily the responsibility of the S.C. Forestry Commission (SCFC) and the United States Department of Agriculture's Forest Service (USFS), with other agencies having supplementary programs. S.C. Forestry Commission provides monthly courtesy exams to SCDHEC's Division of Water Quality and to forest industries. If water quality was impacted by a forestry operation, SCDHEC may institute enforcement action under the South Carolina Pollution Control Act. The United States Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) also provides technical assistance to government, landowners, and land users. Forest land acreage is quantified in the basin-wide and individual watershed evaluations.

Urban Areas

Urbanization has been linked to the degradation of urban waterways. The major pollutants found in runoff from urban areas include sediment, nutrients, oxygen-demanding substances, heavy metals, petroleum hydrocarbons, pathogenic bacteria, and viruses. Suspended sediments constitute the largest mass of pollutant loadings to receiving waters from urban areas. Construction sites are a major source of sediment erosion. Nutrient and bacterial sources of contamination include fertilizer usage, pet wastes, leaves, grass clippings, and faulty septic tanks. Petroleum hydrocarbons result mostly from automobile sources. In the 1980's, the average statewide population growth was 11.7 percent, while the coastal counties had an increase of 22 percent, nearly double the State rate during the same time period. This continuing development and population growth has the potential to make urban runoff the most

significant source of pollution in waters of the State in the future. Urban land acreage is quantified in the basin-wide and individual watershed evaluations.

SCDHEC has a number of statewide programs that address components of urban NPS pollution. The Bureau of Water administers four permitting programs that control runoff from new and existing urban sources. These include the Stormwater and Sediment Reduction program, Municipal Separate Storm Sewer System (MS4), Industrial NPDES Stormwater Permits, and the §401 water quality certification program (see p.26). Additional controls for urban runoff in the coastal zone are implemented by SCDHEC's Oceans and Coastal Resources Management (OCRM) through the State Coastal Zone Management Plan.

SCDHEC's Bureau of Environmental Health's Division of Onsite Wastewater Management administers the Onsite Sewage Disposal System program for the entire State, and oversees the permitting for the installation and management of septic systems. Although not associated with urban land use, this Division permits the septic systems of camping facilities if the facility is not on public sewer. The camp sewage is discharged into a public collection, treatment and disposal system if available, or an onsite wastewater treatment and disposal system (septic tank) is used.

Marinas and Recreational Boating

Potential adverse environmental impacts associated with marinas include dissolved oxygen deficiencies, high concentrations of toxic metals in aquatic organisms, and the potential to cause bacterial contamination of shellfish harvesting areas. In addition, marina construction activities can lead to the physical destruction of sensitive ecosystems and bottom-dwelling aquatic communities. Presently, there are more than 100 marinas in South Carolina, with 68 of them in the coastal zone. The U.S. Army Corps of Engineers and the SCDHEC are responsible for permitting marinas in South Carolina. Within SCDHEC, the two offices that have marina permitting authority are the Office of Ocean and Coastal Resource Management (SCDHEC OCRM) and the Office of Environmental Quality Control (SCDHEC Bureau of Water). SCDHEC OCRM issues critical area permits for marinas within the critical area of the coastal zone. SCDHEC Bureau of Water issues permits for marinas at all other locations within the State and issues §401 Water Quality Certifications (see p.27) for marinas statewide. The U.S. Coast Guard and the S.C. Department of Natural Resources are responsible for managing recreational boating activity.

Mining

South Carolina's mineral production consists of non-fuel minerals that provide raw materials for construction products and a precious metal industry. Portland cement clays (kaolin and brick), sand and gravel, and crushed stone represent the majority of the total mineral value. At the end of FY 2001-2002, there were 540 mining operations in South Carolina affecting more than 23,000 acres. Surface mining has the potential to generate NPS pollution during mineral exploration, mine development extraction, transportation, mining and processing, product storage, waste disposal, or reclamation. Potential nonpoint source impacts related to mining activities generally include hydrologic modification, erosion and sedimentation, water quality deterioration, fish and wildlife disturbances, and public nuisances.

The Department's Bureau of Land and Waste Management has primary regulatory responsibility for mining activities. Within the Bureau, the Division of Mining and Solid Waste Permitting is responsible for administering and implementing the S.C. Mining Act and its associated regulations. The Mining Act serves as part of an overall management plan for NPS pollution from active mines. Mining activities and locations are identified in the appropriate watershed evaluations.

Hydromodification

Hydrologic modification (or hydromodification) is defined as stream channelization, channel modification, and dam construction. These activities can negatively impact water quality, destroy or modify in-stream habitat and increase streambank and shoreline erosion. Two State permits, implemented by the SCDHEC, are involved in the implementation of management measures for hydromodification. A critical area permit is required for coastal waters, saltwater wetlands, and beaches defined as critical areas. A navigable waters permit is required for the remainder of the State. Implementation of State policy for dam construction is similar to control of other hydromodification projects in South Carolina, requiring the same State permits and certifications. In addition, dams require a State dam safety permit or a State stormwater management and sediment reduction permit. The Department must also issue Water Quality Certifications pursuant to §401 of the Federal Clean Water Act for dam construction and hydropower operations licensed by the Federal Energy Regulatory Commission.

Wetlands

Twenty-three percent of South Carolina is covered by 4.5 million acres of wetlands. The U.S. Army Corps of Engineers implements the federal program for regulating development in wetlands with guidelines established by EPA. The Corps delineates wetlands and determines which wetlands fall under regulatory jurisdiction and require a federal permit for development. The Wetlands Reserve Program, administered by the NRCS, is designed to restore and protect wetlands. At the state level, the primary focus of wetland regulation is the §401 Water Quality Certification. In the §401 certification process, applications for wetland alterations may be denied or modified due to the special nature of a wetland or the functions that a wetland provides. Wetland impacts must be compensated through restoration, enhancement, preservation, or creation and protected in perpetuity. Future development would be prohibited in these mitigated and legally protected areas. Knowledge of areas that are restricted from development due to mitigation or special water classification is useful in planning future development in a watershed. Wetland acreage is quantified in the basin-wide and individual watershed evaluations.

Land Disposal

Although modern solid waste disposal sites are considered point sources of pollution and regulated, leachate from sanitary landfills and dumps have the potential to pollute large portions of adjacent groundwater aquifers. Toxic compounds are commonly a part of the overall composition of landfill leachate, especially when the landfill has been used for the disposal of toxic chemicals. There are currently 140 permitted landfills in South Carolina. This total represents 35 municipal solid waste landfills (MSWLF), 62 industrial waste landfills, 41 construction and demolition (C&D) landfills, one sludge monofill, and one ash monofill. Regulatory authority over solid waste disposal activities resides

with SCDHEC's Bureau of Land and Waste Management. All active and closed industrial and municipal solid waste landfills are identified in the appropriate watershed evaluations.

Land application of wastewater or its by products is a form of recycling because it allows recovery of elements needed for crop production. Land application of biosolids may be beneficial and environmentally sound when applied at the correct agronomic rate. Land applying biosolids can benefit farmers by offsetting the costs of fertilizer and lime while reducing the pressure on existing landfills. SCDHEC's Bureau of Water, Division of Water Monitoring, Assessment and Protection, Groundwater Quality Section conducts a program to prevent, monitor, and correct groundwater contamination from nonpoint source pollution from land application of wastewater biosolids, solids, animal manures, biosolids, and sewage sludge. Land application, which is not a discharge, requires a "no discharge" permit (ND). All active industrial and municipal land applications are identified in the appropriate watershed evaluations.

Groundwater Contamination

All aquifers in the State are potential Underground Sources of Drinking Water and are protected under the S.C. Water Classifications and Standards. Groundwaters are thus protected in a manner consistent with the SCDHEC groundwater protection strategy. Staff hydrogeologists implement a screening program for nonpoint source impacts from pits, ponds, and lagoons associated with the permitted storage, treatment, and disposal of industrial and municipal wastewaters. In cases where a groundwater impact has been identified in violation of S.C. Water Classifications and Standards, appropriate actions will be coordinated with the facility owner to ensure regulatory compliance. The hydrogeologist coordinates with the facility owner to implement source identification, contaminant extent assessments, initiation of contaminant remediation systems, and performance evaluations of corrective actions. In addition to releases from wastewater treatment systems, the staff evaluates releases from other nonpoint sources such as above ground tanks, nonregulated fuel oil tanks, spills and/or leaks. Sites with confirmed groundwater impact will be placed under a Consent Agreement or an Order. SCDHEC's South Carolina Groundwater Contamination Inventory quantifies the status of groundwater quality in South Carolina. The sites in the inventory are known groundwater contamination cases in the State, and are referenced by name and county, and updated annually.

Water Quantity

Any withdrawal of surface water or groundwater over 3 million gallons in any month is required to be reported to the Department (per the *Surface Water Withdrawal and Reporting Act* 49-4-10 and the *Groundwater Use and Reporting Act* 49-5-10). These data are compiled into an annual report of total water usage in the state (see SCDHEC's South Carolina Water Use Report). The report also breaks down water usage into categories of interest such as water supply, hydropower, agriculture, and irrigation. In Capacity Use Areas, which are of concern due to the significant groundwater use and subsequent lowering of groundwater levels in major aquifers, withdrawals over 3 million gallons in any month must

receive a permit from the Department. Currently, no quantity permit is required for surface water withdrawals.

Interbasin Transfer of Water

According to The State Interbasin Transfer of Water Act, an interbasin transfer of water permit is required when any entity desires to withdraw, divert, pump, or cause directly the transfer of either 5% of the 7Q10 (seven day, ten year low flow), or one million gallons or more of water a day on any day, whichever is less, from one river basin and use or discharge all or any part of the water in a different river basin. The SCDHEC Board is empowered to negotiate agreements, accords, or compacts on behalf of and in the name of the State of South Carolina with other states or the United States, or both, with any agency, department, or commission of either, or both, relating to transfers of water that impact waters of this State, or are connected to or flowing into those waters. The Board is further empowered to represent this State in connection with water withdrawals, diversions, or transfers occurring in other states, which may affect this State.

Capacity Use Program

As authorized under the Groundwater Use and Reporting Act, the Department may declare a capacity use area if the resource is threatened by increasing demand or the potential problems of saltwater intrusion. The Capacity Use Program requires large groundwater users to obtain a permit in capacity use areas. Permits are required for groundwater withdrawn in excess of 3 million gallons in a month. Permit owners are required to report the amount of groundwater withdrawn per month on an annual basis. As part of the Capacity Use Program, the Department monitors a large number of wells to determine the relationship between water levels and pumpage in order to determine regional impacts and evaluate reserve supply. A reserve supply is maintained to offset drought conditions. Colleton County is within the Low Country Capacity Use Area in the Edisto River Basin.

Growth Potential and Planning

Land use and management can define the impacts to water quality in relation to point and nonpoint sources. Assessing the potential for an area to expand and grow allows for water quality planning to occur and, if appropriate, increased monitoring for potential impairment of water quality. Indicators used to predict growth potential include water and sewer service, road and highway accessibility, and population trends. These indicators and others were used as tools to determine areas within the Edisto River Basin having the greatest potential for impacts to water quality as a result of development.

SCDHEC's Strategic Plan for 2000-2005 (www.scdhec.gov/news/releases/pdf_files/Stratpln.pdf) acknowledges that growth issues are best handled at the local government level. SCDHEC's role is to work with local governments and communities to help them understand the importance of planning for smart growth: buffers, greenspaces, mass transit, subdivision and roadway planning, bike paths and bike lanes, and park and ride lots. SCDHEC can also provide assistance in helping local entities access

information and provide consultation on technical issues such as the establishment of buffers and watershed stormwater planning. Many counties in the Edisto River Basin lack countywide zoning ordinances; therefore, there is little local regulatory power to influence the direction or magnitude of regional growth. The majority of municipalities have zoning ordinances in place; however, much of the growth takes place just outside the municipal boundaries, where infrastructure is inadequate. Section 208 of the Clean Water Act serves to encourage and facilitate the development and implementation of areawide waste treatment management plans. The §208 Areawide Water Quality Management Plans were completed in great detail during the 1970's and have recently been updated. Information from the updated reports is used in the individual watershed evaluations. South Carolina's water quality management plans support consolidation of wastewater treatment facilities into larger regional systems.

Watershed boundaries extend along topographic ridges and drain surrounding surface waters. Roads are commonly built along ridge tops with the best drainage conditions. Cities often develop in proximity to ridges as a result of their plateau terrain. It is not uncommon, then, to find cities or road corridors located along watershed boundaries, and thus influencing or impacting several watersheds.

Watershed Protection and Restoration Strategies

SCDHEC's Bureau of Water is responsible for ensuring that South Carolina's water is safe for drinking and recreation, and suitable to support aquatic life. This section provides an overview of other important Bureau programs and strategies applied statewide to protect and restore water quality. The point and nonpoint source controls described previously assist with achieving these goals.

Under §303(d) of the Federal Clean Water Act, each state is required to provide a comprehensive inventory of impaired waters for which existing required pollution controls are not stringent enough to achieve State water quality standards or Federal Clean Water Act goals. This biennial list, commonly referred to as the "303(d) list", is the basis for targeting waterbodies for watershed-based solutions. A copy of the current §303(d) list can be obtained by contacting the Bureau of Water. Several Bureau programs address these impaired streams in an effort to restore them.

Total Maximum Daily Load

A Total Maximum Daily Load (TMDL) is the calculated maximum allowable pollutant loading to a waterbody at which water quality standards are maintained. A TMDL is made up of two main components, a load allocation and a wasteload allocation. A load allocation is the portion of the receiving water's loading capacity attributed to existing or future nonpoint sources or to natural background sources. The waste load allocation is the portion of a receiving water's loading capacity allocated to an existing or future point source.

A TMDL is a means for recommending controls needed to meet water quality standards in a particular water or watershed. Historically, the typical TMDL has been developed as a wasteload allocation, considering a particular waterbody segment, for a particular point source, to support setting effluent limitations. In order to address the combined cumulative impacts of all sources, broad watershed-based TMDLs are now being developed.

The TMDL process is linked to all other State water quality activities. Water quality impairments are identified through monitoring and assessment. Watershed-based investigations result in source identification and TMDL development. TMDLs form links between water quality standards and point and nonpoint source controls. Where TMDLs are established, they constitute the basis for NPDES permits and for strategies to reduce nonpoint source pollution. The effectiveness and adequacy of applied controls are evaluated through continued monitoring and assessment.

Funding for TMDL implementation is currently available with USEPA's §319 of the Clean Water Act grants. For more information, see the Bureau of Water web page www.scdhec.gov/water or call the Watershed Program at (803) 898-4300.

Antidegradation Implementation

The State's Antidegradation Policy as part of S.C. Regulation 61-68 is represented by a three-tiered approach to maintaining and protecting various levels of water quality and uses; streams included on the §303(d) list are addressed under Tier 1. Tier 1 antidegradation policies apply to all waters of the

State and require that existing uses and the minimum level of water quality for those uses be maintained and protected. Tier 2 policies apply to high quality water where the water quality exceeds the mandatory minimum levels to support the Clean Water Act's goals of propagation of fish, shellfish, wildlife, and recreation in and on the water. The Department considers all the waters of the State as high quality waters. Tier 3 policies apply to the maintenance of water quality in waters that constitute an Outstanding National Resource Water and do not allow for any permanent permitted dischargers. Outstanding Resource Waters of the State are provided a higher level of protection than Tier 2, but do not meet the requirements of Tier 3.

Tier 1 protection will be implemented when applying numeric standards included in Regulation 61-68 for human health, aquatic life, and organoleptic protection as follows: if a waterbody has been affected by a parameter of concern causing it to be on the §303(d) list, then the Department will not allow a permitted net increase of loading for the parameter of concern unless the concentration will not contribute to a violation of water quality standards. This no net increase will be achieved by reallocation of existing total load(s) or by meeting applicable water quality standard(s) at the end-of-pipe. No discharge will be allowed to cause or contribute to further degradation of a §303(d) listed waterbody.

The Antidegradation Rules apply to both nonpoint source pollution and for point sources into impaired waters. Many activities contributing to nonpoint source pollution are controlled with voluntary measures. The Department implements permitting or certification programs for some of these activities and has the opportunity to ensure compliance with the Antidegradation Rules. The activities of primary concern are land development projects which are immediately adjacent to and discharge runoff or stormwater into impaired waters.

401 Water Quality Certification Program

If a Federal permit for a discharge into waters of the State, including wetlands, is required, the Department must issue Water Quality Certification pursuant to §401 of the Federal Clean Water Act. Certification is required for permits issued by the U.S. Army Corps of Engineers for construction in navigable waters and for deposition of dredged or fill material.

Regulation 61-101 presents administrative and technical guidance for the water quality certification program and requires SCDHEC to consider whether or not a project is water dependent; whether or not there are feasible alternatives which will have less adverse consequences on water quality and classified uses; the intended purpose of the project; and all potential water quality impacts of the project, both direct and indirect, over the life of the project. Any project with the potential to affect waters of the State must be conducted in such a manner to maintain the specified standards and classified and existing water uses.

As a routine part of the §401 Water Quality Certification review process, the waterbody in question is identified as impaired or not impaired according to the §303(d) list. If it is impaired, the parameter of concern is noted, along with any steps required to prevent further degradation of the water quality of that waterbody. In an effort to facilitate watershed restoration where appropriate, mitigation for unavoidable wetland impacts is encouraged in areas that improve §303(d) listed waters.

Stormwater Program

Stormwater discharges result from precipitation during rain events. Runoff washes pollutants associated with industrial activities (including construction activity), agricultural operations, and commercial and household sites directly into streams, or indirectly into drainage systems that eventually drain into streams. The SCDHEC Stormwater Permitting Program focuses on pollution prevention to reduce or eliminate stormwater pollution. The Department has general permitting authority for stormwater discharges associated with industrial activity, including construction. General NPDES permits SCR000000 and SCR100000 for industrial and construction activities, respectively, require permittees to develop and implement stormwater pollution prevention plans that establish best management practices to effectively reduce or eliminate the discharge of pollutants via stormwater runoff.

The Stormwater and Agricultural Permitting Section is responsible for issuing NPDES stormwater permits to prevent degradation of water quality as well as for issuing state sediment and erosion control permits for construction sites. The NPDES permits are issued under the authority of the federal Clean Water Act and the SC Pollution Control Act. The state sediment and erosion control permits are issued under the authority of two SC laws. The SC Erosion and Sediment Reduction Act of 1983 addresses construction on state owned or managed land. The SC Stormwater Management and Sediment Reduction Act of 1991 addresses construction on land that is not state owned or managed. Currently, NPDES permits are required for: construction sites 1 acre and greater; construction sites in the coastal area that are within 1/2 mile of a receiving water body; and construction sites less than 1 acre on a case-by-case basis where water quality is a concern. Permits are required under the state sediment and erosion control for construction sites that are greater than 2 acres; however, there are exemptions under the law and regulation. The State Sediment and Erosion Program is somewhat duplicative of the NPDES Stormwater Program. The state program created by the 1991 Act can be delegated to local governments. Until a local government becomes delegated, SCDHEC's Office of Ocean and Coastal Resource Management is delegated the State Sediment and Erosion Control Program in the coastal area. The Stormwater and Agricultural Permitting Section manages the NPDES Stormwater Program in all areas of the state and the State Sediment and Erosion Control Program in the areas of the state where the program is not delegated to another entity.

Regulation 61-9 requires a compilation of all existing State water quality data with STORET data being used as a baseline. If analysis indicates a decrease in water quality then corrective measures must be taken. The permittee will identify all impaired water bodies in a Stormwater Management Plan (SWMP). In addition, existing pollution discharge control methods will be identified and incorporated into the SWMP. Procedures, processes, and methods to control the discharge of pollutants from the municipal separate storm sewer system (MS4) into impaired waterbodies and publicly owned lakes included on the §303(d) list will be described in the SWMP. The effectiveness of these controls will be assessed and necessary corrective measures, if any, shall be developed and implemented.

Permits for municipal systems allow communities to design stormwater management programs that are suited for controlling pollutants in their jurisdiction. There are three population-based categories of municipal separate storm sewers: large municipal (population of 250,000 or greater), medium

municipal (population of 100,000 or more but less than 250,000), and small municipal (population less than 100,000). Large and medium MS4s have been regulated since the 1990s. Those small MS4s within the boundaries of an urbanized area are called Regulated Small MS4s and were required to submit MS4 NPDES applications on or before March 10, 2003. MS4 NPDES Permits are required for all large, medium, and regulated small MS4s.

South Carolina Animal Feeding Operations Strategy

Among the general categories of pollution sources, agriculture ranks as the number one cause of stream and lake impairment nationwide. Many diseases can potentially be contracted from drinking water or coming into contact with waters contaminated with animal wastes. The Department uses S.C. Regulation 61-43: *Standards for the Permitting of Agricultural Animal Facilities* to address the permitting of animal feeding operations (AFOs). Implementing these regulations and their corresponding compliance efforts are a priority for the Department in order to reduce public health and environmental impacts from AFOs. There are approximately 1,100 active AFOs in S.C. While previously, there were no federally defined concentrated animal feeding operations (CAFOs) in operation in South Carolina, EPA modified the definition of a CAFO in the NPDES regulations in December 2002. These regulations have now been adopted in S.C. Based on the new federal CAFO definition, S.C. has approximately 200 CAFOs that require NPDES permits. Using the Watershed Program cycle and the division of the State into five regions, AFOs will be monitored and inspected by region. The §303(d) list will be used to prioritize the inspections. After all the inspections have been made in a region, the Department will move to the river basins in the next region in the watershed cycle. The Department is continuing to work in cooperation and coordination with the U.S. Department of Agriculture, the Natural Resources Conservation Service, the S.C. Department of Agriculture, the S.C. Soil and Water Conservation Districts, and the Clemson Extension Service.

Sanitary Sewer Overflow Strategy

Sanitary sewers are designed to collect municipal and industrial wastewater, with the allowance for some acceptable level of infiltration and inflow, and transport these flows to a treatment facility. When the sewer system is unable to carry these flows, the system becomes surcharged and an overflow will occur. Sanitary sewer overflows (SSOs) have existed since the introduction of separate sanitary sewers and most are caused by inadequate operation, maintenance, or management of the collection system.

The Department encourages utilities to embrace the principals of EPA's capacity Management, Operations, and Maintenance (cMOM) program. Through this program utilities can ensure adequate funding and capacity as well as a proactive approach to operations and maintenance. Those that have implemented cMOM programs have been able to significantly reduce or eliminate overflows from their collection systems. Additionally, the Department has adopted requirements for operation and maintenance of sewer systems in Regulation 61-9, Water Pollution Control Permits.

The Department's approach has been to shift resources historically applied to treatment plant inspections to include evaluations of pump stations and collection systems where problems are suspected.

To assist evaluators in identifying water quality violations related to SSOs, staff have utilized the 303(d) list of impaired waters to identify waters impacted by fecal coliform or other appropriate pollutants and correlate those with collection systems with incidences of SSOs. The Department's Enforcement Referral Procedures Document is to be used to determine when a collection system should be referred to enforcement for SSOs. The enforcement process allows for the Department to consider actions taken by the collection system such as: timely and proper notification, containment and mitigation of discharge, voluntarily conducting self evaluations, and requests for compliance assistance. The Department will take immediate action where it has been determined that SSOs have occurred and the collection system has not made timely and proper notification.

Referral Strategy for Effluent Violations

The Department has developed referral effluent violation guidelines to specifically address discharges into impaired waters. The goal of the referral guidelines is to reduce pollutant discharges into impaired waters in order to ultimately restore them to their full potential usage. To achieve this goal, enforcement actions are initiated earlier in an effort to improve the quality of waters that do not meet standards. If a stream is impaired by a pollutant and the permit limit for that pollutant is exceeded more than once in a running annual reporting period, formal enforcement action will be initiated against the discharger.